1975

The Fatty Liver Hemorrhagic Syndrome (FLHS)

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A.S. Series 75-28

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Fatty liver hemorrhagic syndrome (FLHS) has become a major cause of mortality among caged laying hens. It was second (14%) to lymphoid leukosis as the cause of death in 1974 among those hens submitted to the diagnostic laboratory from this research station. The problem seems to be increasing with the increased use of high energy-low protein layer diets.

The disease is often characterized by a 20 to 25% increase in body weight along with a 25 to 30% decrease in egg production and an increase in mortality from excessive abdominal and liver fat leading to liver hematomas.

FLHS is hard to produce in the laboratory. A normal level of mortality from the disease usually occurs, but this level is not adequate for studying the cause of the problem. Workers at Michigan State developed a method of feeding that produces high levels of FLHS by forcing excess feed into the crop of the laying hen. We have adapted this method to make it possible to test different agents for their possible effects in decreasing the level of the disease. One experiment using the force-feeding technique has been completed and others are either under way or being planned.

In the first experiment, high energy (10% fat), corn-soybean diets were force-fed at about 125% of normal intake for five weeks to 72 hens. Biotin and choline alone and combined at twice the NRC recommended levels were supplemented to give four diets. Three commercial strains that had been grown on 10 or 12% protein diets were used to complete the factorial design. Ad libitum feeding of these diets is being utilized on another 308 laying hens with the same factorial design. This second experiment is scheduled to run the full 14-month laying cycle.

Body weight and liver data for the first experiment are shown in tables 1 to 3. No large differences occurred due to biotin or choline addition, but there was a decrease in lipid content and size of the livers due to choline. The overall lipid content of the livers was not as high as expected, since a 40 to 50% level is not any higher than had been shown in our previous work with these diets using ad libitum feeding. Strain 3 controlled their liver lipid content better than strain 1 or strain 2, but liver size was still large.

Further work is now under way to see if lower fat levels in the diet will produce a fatty liver more easily. Liver fat content may actually be decreased by a fat addition to the diet. A possible reason is that the bile required for fat absorption in the small intestine is produced from liver fat. Further work may actually show dietary fat additions to be a deterrent of FLHS.

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Table 1. Effect of Diet and Strain on Body Weight (kg)

	Protein of grower diet	Laying diet				
		Control[1]	Control + choline[2]	Control + biotin[3]	Control + choline + biotin	Avg.
Strain 1	10%	1.93	1.84	1.98	1.90	1.91
	12%	2.09	2.24	2.07	2.08	2.12
Strain 2	10%	1.98	1.94	2.04	1.91	1.96
	12%	1.92	2.03	1.87	2.18	2.00
Strain 3	10%	1.88	1.88	1.89	1.77	1.85
	12%	2.24	2.21	1.73	1.99	2.04
Average		2.00	2.02	1.93	1.97	

[1]10% yellow grease in a 14% protein corn-soy diet.
[2]1500 mg/kg.
[3]1.1 mg/kg.

Table 2. Fat Content of Livers as Affected by Diet and Strain (Percent Moisture-Free Lipid Extract)

	Protein of grower diet	Laying diet				
		Control[1]	Control + choline[2]	Control + biotin[3]	Control + choline + biotin	Avg.
Strain 1	10%	41.5	49.5	50.6	48.5	47.5
	12%	61.5	50.7	57.9	43.5	53.4
Strain 2	10%	51.1	35.8	35.0	39.4	40.3
	12%	54.4	38.1	56.9	48.3	49.4
Strain 3	10%	40.9	43.0	41.4	35.4	40.2
	12%	37.9	34.0	47.4	43.7	40.8
Average		47.9	41.9	48.2	43.1	

[1]10% yellow grease in a 14% protein corn-soy diet.
[2]1500 mg/kg.
[3]1.1 mg/kg.

Table 3. Effect of Diet and Strain on Relative Liver Weight (Percent Liver of Body Weight)

	Protein of grower diet	Laying diet				
		Control[1]	Control + choline[2]	Control + biotin[3]	Control + choline + biotin	Avg.
Strain 1	10%	2.9	3.4	3.5	3.6	3.4
	12%	3.8	3.3	3.6	3.1	3.5
Strain 2	10%	3.1	3.0	2.8	3.4	3.1
	12%	3.3	3.0	3.7	3.2	3.3
Strain 3	10%	3.1	3.4	3.6	3.6	3.4
	12%	2.6	3.3	3.4	3.3	3.2
Average		3.3	3.2	3.4	3.4	

[1] 10% yellow grease in a 14% protein corn-soy diet.
[2] 1500 mg/kg.
[3] 1.1 mg/kg.